

# SEQUENCE LISTING

<110> HARA, SEIICHI  
YOKOZEKI, KENZO  
ABE, ISAO  
TONOUCHI, NAOTO  
JOJIMA, YASUKO

<120> NOVEL PEPTIDE-FORMING ENZYME GENES

<130> 247848US0

<150> JP 2003-16765

<151> 2003-01-24

<150> US 60/491,612

<151> 2003-08-01

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<170> PatentIn version 3.1

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Gly	Asp	Asp 195	Phe	His	His	Asn	Gly 200	Val	Leu	Phe	Leu	Asn 205	Asp	Ser	Phe	
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Asp 225	Lys	Gly	Pro	Lys	Arg 230	Phe	Glu	Tyr	Pro	Ile 235	Lys	Asp	Asn	Tyr	Arg 240	
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Gln	Phe	Trp 275	Gln	Asp	Arg	Asn	Val 280	Leu	Pro	His	Leu	Thr 285	Asn	Val	Gln	
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Glu	His	Tyr 355	Gln	Gln	Glu	Ile	Glu 360	Leu	Pro	Phe	Phe	Asn 365	Tyr	Tyr	Leu	
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Lys 370	Asp	Lys	Gly	Asn	Phe	Lys 375	Pro	Thr	Glu	Ala	Thr 380	Ile	Phe	Ile	Thr	
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gtg Val 465	tat Tyr	caa Gln	tct Ser	gat Asp	att Ile 470	ttg Leu	aca Thr	gaa Glu	gat Asp	att Ile 475	acg Thr	ctt Leu	gct Ala	ggt Gly	cct Pro 480	1500
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cgc Arg 530	gga Gly	aaa Lys	tat Tyr	aga Arg	aat Asn	agt Ser 535	ttc Phe	tct Ser	aac Asn	ccc Pro	gaa Glu 540	gct Ala	atg Met	gtt Val	ccg Pro	1692
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580 585 590

act tct aaa gat tat tta aaa caa acg caa cga att tat cat act tct 1884  
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595 600 605

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Thr Lys Leu Phe Thr Ala Ile Tyr Gln Pro Lys Asp Lys Thr Lys Gln  
50 55 60

Tyr Pro Val Leu Leu Asn Arg Thr Pro Tyr Thr Val Ala Pro Tyr Gly  
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Val Asn Glu Tyr Lys Lys Ser Leu Gly Asn Phe Pro Thr Glu Met Arg  
85 90 95

Glu Gly Phe Ile Phe Val Tyr Gln Asp Val Arg Gly Lys Trp Met Ser  
100 105 110

Glu Gly Glu Phe Glu Asp Val Arg Pro Ile Asn Pro Ser Lys Ser Lys

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Ser	Tyr	Pro	Gly	Phe	Tyr	Ser	Thr	Met	Ser	Leu	Val	Asn	Ser	His	Pro
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Thr	Leu	Lys	Ala	Val	Ser	Pro	Gln	Ala	Pro	Val	Thr	Asn	Trp	Phe	Leu
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330

335

Ser Asn Gly Ser Thr Phe Gly Asp Met Gln Phe Ala Ser Asn Thr Ser  
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Glu His Tyr Gln Gln Glu Ile Glu Leu Pro Phe Phe Asn Tyr Tyr Leu  
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Lys Asp Lys Gly Asn Phe Lys Pro Thr Glu Ala Thr Ile Phe Ile Thr  
 370 375 380

Gly Ser Asn Glu Trp Lys Gln Phe Asp Ala Trp Pro Pro Lys Asn Val  
 385 390 395 400

Thr Thr Gln Lys Ile Tyr Leu Gln Gln Asn Gly Lys Ile Ala Phe Asn  
 405 410 415

Lys Thr Asn Thr Thr Thr Thr Phe Asp Glu Tyr Val Ala Asp Pro Asn  
 420 425 430

Ser Pro Val Pro Tyr Ser Gly Gly Val Leu Glu Thr Arg Ser Arg Glu  
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Tyr Met Val Asp Asp Gln Arg Phe Ala Ser Thr Arg Pro Asp Val Met  
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Val Tyr Gln Ser Asp Ile Leu Thr Glu Asp Ile Thr Leu Ala Gly Pro  
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Val Ile Asn His Leu Val Val Ser Thr Thr Gly Thr Asp Ala Asp Tyr  
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Val Val Lys Leu Ile Asp Val Tyr Pro Glu Asn Thr Pro Lys Phe Asn  
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Asn Lys Leu Met Ala Gly Tyr Gln Asn Leu Ile Arg Ala Glu Ile Met  
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Arg Gly Lys Tyr Arg Asn Ser Phe Ser Asn Pro Glu Ala Met Val Pro

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535

540

Asn Lys Glu Thr Asn Val Thr Tyr Thr Met Pro Asp Val Gly His Thr  
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Phe Lys Lys Gly His Arg Ile Met Ile Gln Val Gln Asn Ser Trp Phe  
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Pro Leu Ala Asp Arg Asn Pro Gln Gln Phe Met Asn Val Tyr Glu Ala  
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 Met Lys Asn Thr Ile Ser Cys Leu Thr Leu Ala Leu Leu Ser Ala Ser  
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cag tta cat gct caa aca gct gcc gac tcg gct tat gtt aga gat cat 156  
 Gln Leu His Ala Gln Thr Ala Ala Asp Ser Ala Tyr Val Arg Asp His  
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tat gaa aag acc gaa gta gca att ccc atg cga gat ggg aaa aaa tta 204  
 Tyr Glu Lys Thr Glu Val Ala Ile Pro Met Arg Asp Gly Lys Lys Leu  
 35 40 45

ttt act gcg atc tac agt cca aaa gac aaa tcc aag aaa tat cca gtt 252  
 Phe Thr Ala Ile Tyr Ser Pro Lys Asp Lys Ser Lys Lys Tyr Pro Val  
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ttg ctc aat aga acg ccc tac acg gtt tca cct tat ggg cag aac gaa 300  
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Ile	Phe	Val	Tyr	Gln	Asp	Val	Arg	Gly	Lys	Trp	Met	Ser	Glu	Gly	Asp	
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Tyr	Gln	Glu	Gln	Phe	Glu	Gln	Pro	Phe	Phe	Lys	Tyr	Tyr	Leu	Lys	Asp	
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Glu	Gly	Asn	Phe	Ala	Pro	Ser	Glu	Ala	Asn	Ile	Phe	Val	Ser	Gly	Ser	
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aac	gaa	tgg	aaa	cat	ttc	gaa	cag	tgg	cca	cca	aaa	aat	gta	gag	aca	1260
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Lys	Lys	Leu	Tyr	Phe	Gln	Pro	Gln	Gly	Lys	Leu	Gly	Phe	Asp	Lys	Val	
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Asn	Phe	Leu	Lys	Val	Ser	Ser	Thr	Gly	Thr	Asp	Ala	Asp	Tyr	Val	Val	
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Lys	Gly	His	Arg	Ile	Met	Val	Gln	Val	Gln	Asn	Ser	Trp	Phe	Pro	Leu		
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gca	gaa	cga	aat	cca	cag	gtg	ttt	tta	gca	cct	tat	aca	gct	acc	aaa	1836	
Ala	Glu	Arg	Asn	Pro	Gln	Val	Phe	Leu	Ala	Pro	Tyr	Thr	Ala	Thr	Lys		
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Ala	Asp	Phe	Arg	Lys	Ala	Thr	Gln	Arg	Ile	Phe	His	Asp	Val	Asn	Asn		
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gcc	aca	tac	atc	gaa	ttt	tct	gtc	ctc	aaa	gat	tagcaggt	aaatttcgaaa				1935	
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Tyr	Glu	Lys	Thr	Glu	Val	Ala	Ile	Pro	Met	Arg	Asp	Gly	Lys	Lys	Leu
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Phe Thr Ala Ile Tyr Ser Pro Lys Asp Lys Ser Lys Lys Tyr Pro Val  
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Leu Leu Asn Arg Thr Pro Tyr Thr Val Ser Pro Tyr Gly Gln Asn Glu  
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Tyr Lys Lys Ser Leu Gly Asn Phe Pro Gln Met Met Arg Glu Gly Tyr  
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Ile Phe Val Tyr Gln Asp Val Arg Gly Lys Trp Met Ser Glu Gly Asp  
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Phe Glu Asp Ile Arg Pro Thr Thr Tyr Ser Lys Asp Lys Lys Ala Ile  
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Asp Glu Ser Thr Asp Thr Tyr Asp Ala Leu Glu Trp Leu Gln Lys Asn  
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Leu Lys Asn Tyr Asn Gly Lys Ala Gly Leu Tyr Gly Ile Ser Tyr Pro  
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Gly Phe Tyr Ser Thr Val Gly Leu Val Lys Thr His Pro Ser Leu Lys  
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Ala Val Ser Pro Gln Ala Pro Val Thr Asp Trp Tyr Ile Gly Asp Asp  
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Phe His His Asn Gly Val Leu Phe Leu Gln Asp Ala Phe Thr Phe Met  
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Ser Thr Phe Gly Val Pro Arg Pro Lys Pro Ile Thr Pro Asp Gln Phe  
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Lys Gly Lys Ile Gln Ile Lys Glu Ala Asp Lys Tyr Asn Phe Phe Ala  
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Glu Ala Gly Thr Ala Arg Glu Leu Lys Glu Lys Tyr Phe Gly Asp Ser  
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Val Gln Phe Trp Asn Asp Leu Phe Lys His Pro Asp Tyr Asp Asp Phe  
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Trp Lys Ser Arg Val Ile Thr Asn Ser Leu Gln Glu Val Lys Pro Ala  
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Glu Gly Asn Phe Ala Pro Ser Glu Ala Asn Ile Phe Val Ser Gly Ser  
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Asn Glu Trp Lys His Phe Glu Gln Trp Pro Pro Lys Asn Val Glu Thr  
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Lys Lys Leu Tyr Phe Gln Pro Gln Gly Lys Leu Gly Phe Asp Lys Val  
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Gln Arg Thr Asp Ser Trp Asp Glu Tyr Val Thr Asp Pro Asn Lys Pro  
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Val Pro His Gln Gly Gly Val Ile Gln Asn Arg Thr Arg Glu Tyr Met  
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Val Asp Asp Gln Arg Phe Ala Ala Ser Arg Pro Asp Val Met Val Tyr  
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Gln Thr Glu Pro Leu Thr Glu Asp Leu Thr Ile Val Gly Pro Ile Lys  
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Met Thr Pro Phe Lys Ser Phe Ser Phe Ile Phe Leu Phe Ile Phe Thr
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Ser Leu Ser Ala Ser Ala Gln Gln Ser Asp Ser Ala Tyr Ile Arg Gln
          20          25          30

aac tat acc aaa ata gaa agg ctg atc cct atg cgg gat ggc att aag      204
Asn Tyr Thr Lys Ile Glu Arg Leu Ile Pro Met Arg Asp Gly Ile Lys
          35          40          45

cta ttt aca gcc att tac atc ccc aaa gac aaa agc aag aag tat cct      252
Leu Phe Thr Ala Ile Tyr Ile Pro Lys Asp Lys Ser Lys Lys Tyr Pro
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Phe Met Leu Asn Arg Thr Pro Tyr Thr Val Ser Pro Tyr Gly Glu Asn
65          70          75          80

aat tat aaa aca agc ctt ggc ccc tct ccg ctc ttt ata aaa gaa ggc      348
Asn Tyr Lys Thr Ser Leu Gly Pro Ser Pro Leu Phe Ile Lys Glu Gly
          85          90          95

ttt atc ttt gtt tat cag gat gta agg ggc aaa tgg atg agt gag gga      396
Phe Ile Phe Val Tyr Gln Asp Val Arg Gly Lys Trp Met Ser Glu Gly
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aaa ttt gaa gac gta agg ccg caa ata gcc agc aag aaa cgc aaa acg      444
Lys Phe Glu Asp Val Arg Pro Gln Ile Ala Ser Lys Lys Arg Lys Thr
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gat att gat gaa agc tcc gat act tat gat acg atc gac tgg ctg atc      492
Asp Ile Asp Glu Ser Ser Asp Thr Tyr Asp Thr Ile Asp Trp Leu Ile
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agg aac att cct gga aac aac cgt aaa acc ggt att tac ggt atc tca      540
Arg Asn Ile Pro Gly Asn Asn Arg Lys Thr Gly Ile Tyr Gly Ile Ser
145          150          155          160

tac cca ggc ttt tat gct act gct gcc cta cca gat gcg cat cca tct      588
Tyr Pro Gly Phe Tyr Ala Thr Ala Ala Leu Pro Asp Ala His Pro Ser
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tta aag gca gta tcg ccc cag gct ccg gtt acc gac tgg ttt ata ggc      636
Leu Lys Ala Val Ser Pro Gln Ala Pro Val Thr Asp Trp Phe Ile Gly
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gat gat ttt cat cac aat ggc acc ttg ttc ctt gca gat atc ttt agc      684

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Asp	Thr	Ile	Arg	Phe	Trp	Asn	Asp	Ile	Asn	Ala	His	Thr	Asn	Tyr	Asp	
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gcc	ttc	tgg	aaa	gcc	cgt	aac	att	acg	ccg	cat	tta	att	ggg	gta	aaa	924
Ala	Phe	Trp	Lys	Ala	Arg	Asn	Ile	Thr	Pro	His	Leu	Ile	Gly	Val	Lys	
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Pro	Ala	Val	Leu	Val	Val	Gly	Gly	Phe	Phe	Asp	Ala	Glu	Asp	Leu	Tyr	
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Thr	Ser	Tyr	Gln	Gln	Asn	Val	Glu	Phe	Pro	Phe	Phe	Met	Gln	Tyr	Leu	
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Tyr	Met	Ile	Asp	Asp	Gln	Arg	Phe	Ala	Ser	Arg	Arg	Pro	Asp	Val	Arg	
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Val	Ala	His	Thr	Phe	Lys	Lys	Gly	His	Arg	Ile	Met	Ile	Gln	Val	Gln	
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Asn	Ser	Trp	Phe	Pro	Leu	Ala	Asp	Arg	Asn	Pro	Gln	Gln	Phe	Met	Asp	
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Ile	Tyr	Gln	Ala	Glu	Pro	Gly	Asp	Phe	Arg	Lys	Ala	Thr	His	Arg	Ile	
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Phe His Asp Val His Asn Ala Ser Ala Ile Thr Val Asn Val Leu Lys  
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Asn Tyr Lys Thr Ser Leu Gly Pro Ser Pro Leu Phe Ile Lys Glu Gly  
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Phe Ile Phe Val Tyr Gln Asp Val Arg Gly Lys Trp Met Ser Glu Gly  
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Lys Phe Glu Asp Val Arg Pro Gln Ile Ala Ser Lys Lys Arg Lys Thr  
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Asp Ile Asp Glu Ser Ser Asp Thr Tyr Asp Thr Ile Asp Trp Leu Ile  
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Arg Asn Ile Pro Gly Asn Asn Arg Lys Thr Gly Ile Tyr Gly Ile Ser

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365

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Val Ala His Thr Phe Lys Lys Gly His Arg Ile Met Ile Gln Val Gln

565

570

575

Asn Ser Trp Phe Pro Leu Ala Asp Arg Asn Pro Gln Gln Phe Met Asp  
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Ile Tyr Gln Ala Glu Pro Gly Asp Phe Arg Lys Ala Thr His Arg Ile  
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108

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156

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204

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252

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300

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348

ggc ccc tac ggc ccc ggc aaa tac aag ctc aac ctg ggc ccc agc agc  
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396

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444

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acc	att	gag	tgg	ctt	ctg	aag	cac	ggg	ccc	aag	aat	aac	ggc	cgc	gta	588
Thr	Ile	Glu	Trp	Leu	Leu	Lys	His	Gly	Pro	Lys	Asn	Asn	Gly	Arg	Val	
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ggc	cag	tgg	ggc	atc	tcc	tac	ccc	ggc	tac	tat	acc	gct	act	ggc	cta	636
Gly	Gln	Trp	Gly	Ile	Ser	Tyr	Pro	Gly	Tyr	Tyr	Thr	Ala	Thr	Gly	Leu	
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Leu	Ser	Arg	His	Lys	Ala	Leu	Lys	Ala	Ser	Ser	Pro	Gln	Ala	Pro	Ile	
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gcc	gac	tgg	ttc	tgg	gac	gat	ttt	cac	cac	aac	ggc	gcg	ttc	ttc	ctg	732
Ala	Asp	Trp	Phe	Trp	Asp	Asp	Phe	His	His	Asn	Gly	Ala	Phe	Phe	Leu	
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Pro	His	Ala	Phe	Asn	Phe	Leu	Ala	Ser	Phe	Gly	Leu	Ala	Arg	Pro	Gln	
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ccc	acg	cct	acc	ggc	aac	ccc	ggc	ttc	aag	cac	ggc	acc	ccc	gat	ggc	828
Pro	Thr	Pro	Thr	Gly	Asn	Pro	Gly	Phe	Lys	His	Gly	Thr	Pro	Asp	Gly	
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Tyr	Asp	Phe	Phe	Leu	Lys	Met	Gly	Pro	Leu	Lys	Asn	Ala	Asp	Ala	Asn	
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Tyr	Tyr	Lys	Gly	Lys	Val	Ala	Phe	Trp	Asn	Glu	Met	Ala	Ser	His	Pro	
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Asn	Tyr	Asp	Glu	Phe	Trp	Gln	Ala	Arg	Asn	Leu	Arg	Pro	His	Leu	Lys	
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	305				310					315					320	
gcc	gag	gac	ctg	ttt	ggc	gcc	ctg	aaa	acc	tac	gaa	agc	atc	gag	aag	1068
Ala	Glu	Asp	Leu	Phe	Gly	Ala	Leu	Lys	Thr	Tyr	Glu	Ser	Ile	Glu	Lys	

325										330					335					
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Gln	Asn	Pro	Gly	Met	Arg	Asn	Gly	Leu	Val	Met	Gly	Pro	Trp	Val	His					
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Gly	Gly	Trp	Ala	Arg	Gly	Thr	Gly	Glu	Met	Val	Gly	Asn	Val	Ala	Tyr					
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ggc	gag	tcg	ccg	tcg	ttg	tat	tac	cag	aag	cag	att	gaa	gcg	ccg	ttc	1212				
Gly	Glu	Ser	Pro	Ser	Leu	Tyr	Tyr	Gln	Lys	Gln	Ile	Glu	Ala	Pro	Phe					
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ttc	aaa	tca	tat	ctg	aag	gat	ggc	aaa	cct	gcc	gct	acc	ccc	gag	gct	1260				
Phe	Lys	Ser	Tyr	Leu	Lys	Asp	Gly	Lys	Pro	Ala	Ala	Thr	Pro	Glu	Ala					
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Thr	Ile	Phe	Glu	Ser	Gly	Thr	Asn	Arg	Trp	Arg	Ser	Phe	Glu	Thr	Trp					
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ccg	ccc	aaa	gaa	gcc	aaa	gag	cgc	act	ttg	tac	ttt	cag	tcg	gcc	ggg	1356				
Pro	Pro	Lys	Glu	Ala	Lys	Glu	Arg	Thr	Leu	Tyr	Phe	Gln	Ser	Ala	Gly					
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Leu	Ser	Asp	Pro	Ala	His	Pro	Val	Pro	Phe	Thr	Glu	Ala	Thr	Ala	Thr					
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Arg	Pro	Asp	Val	Leu	Thr	Tyr	Gln	Thr	Glu	Ala	Leu	Thr	Glu	Asp	Met					
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Thr	Leu	Ala	Gly	Pro	Ile	Glu	Ala	Leu	Leu	Gln	Val	Ala	Thr	Thr	Gly					
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Thr	Pro	Asn	Asn	Pro	Ser	Thr	Asn	Pro	Ala	Val	Lys	Leu	Gly	Gly	Tyr					

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Gln Gln Met Val Arg Ser Glu Val Met Arg Gly Arg Phe Arg Asn Ser			
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ttc tcc aag ccc gaa gcc ttt gta ccg gaa cag gta acg gcc gtg ccc			1788
Phe Ser Lys Pro Glu Ala Phe Val Pro Glu Gln Val Thr Ala Val Pro			
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ttc acg gtg cag gac ctg tgc cac acc ttc cgg aaa gga cac cgc ctg			1836
Phe Thr Val Gln Asp Leu Cys His Thr Phe Arg Lys Gly His Arg Leu			
	580	585	590
atg gtg cag gtg caa agc agc tgg ttc ccg att gtt gac cgc aac ccg			1884
Met Val Gln Val Gln Ser Ser Trp Phe Pro Ile Val Asp Arg Asn Pro			
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cag acc ttc gta ccc aat att ttc gag gcc gat gag aag gat ttc cag			1932
Gln Thr Phe Val Pro Asn Ile Phe Glu Ala Asp Glu Lys Asp Phe Gln			
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gcc gcc acg cat cgg ctg tac cat tcg ccg gcg cat agc tcg cag ctc			1980
Ala Ala Thr His Arg Leu Tyr His Ser Pro Ala His Ser Ser Gln Leu			
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35	45
Ala Tyr Ile Lys Glu Arg Tyr Thr Lys Thr Glu Tyr Gln Ile Pro Met	
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Asn	Lys	Val	Lys	Tyr 85	Pro	Ile	Leu	Leu	Asn 90	Arg	Thr	Pro	Tyr	Ala 95	Ile
Gly	Pro	Tyr	Gly 100	Pro	Gly	Lys	Tyr	Lys 105	Leu	Asn	Leu	Gly	Pro 110	Ser	Ser
Thr	Met	Met 115	His	Glu	Gly	Tyr	Ile 120	Phe	Ala	Tyr	Gln	Asp 125	Val	Arg	Gly
Arg	Tyr 130	Met	Ser	Glu	Gly	Glu 135	Phe	Val	Asp	Val	Arg 140	Pro	Glu	Lys	Asp
Met 145	His	Lys	Gly	Lys	Asn 150	Asp	Ile	Asp	Glu	Gly 155	Thr	Asp	Thr	Tyr	Asp 160
Thr	Ile	Glu	Trp	Leu 165	Leu	Lys	His	Gly	Pro 170	Lys	Asn	Asn	Gly	Arg 175	Val
Gly	Gln	Trp	Gly 180	Ile	Ser	Tyr	Pro	Gly 185	Tyr	Tyr	Thr	Ala	Thr 190	Gly	Leu
Leu	Ser	Arg 195	His	Lys	Ala	Leu	Lys 200	Ala	Ser	Ser	Pro	Gln 205	Ala	Pro	Ile
Ala	Asp 210	Trp	Phe	Trp	Asp	Asp 215	Phe	His	His	Asn	Gly 220	Ala	Phe	Phe	Leu
Pro 225	His	Ala	Phe	Asn	Phe 230	Leu	Ala	Ser	Phe	Gly 235	Leu	Ala	Arg	Pro	Gln 240
Pro	Thr	Pro	Thr	Gly 245	Asn	Pro	Gly	Phe	Lys 250	His	Gly	Thr	Pro	Asp 255	Gly
Tyr	Asp	Phe	Phe 260	Leu	Lys	Met	Gly	Pro 265	Leu	Lys	Asn	Ala	Asp 270	Ala	Asn

Tyr Tyr Lys Gly Lys Val Ala Phe Trp Asn Glu Met Ala Ser His Pro  
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Asn Tyr Asp Glu Phe Trp Gln Ala Arg Asn Leu Arg Pro His Leu Lys  
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Asn Leu Asn Lys Gly Thr Ala Val Leu Thr Val Gly Gly Phe Asn Asp  
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Ala Glu Asp Leu Phe Gly Ala Leu Lys Thr Tyr Glu Ser Ile Glu Lys  
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Gln Asn Pro Gly Met Arg Asn Gly Leu Val Met Gly Pro Trp Val His  
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Gly Gly Trp Ala Arg Gly Thr Gly Glu Met Val Gly Asn Val Ala Tyr  
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Gly Glu Ser Pro Ser Leu Tyr Tyr Gln Lys Gln Ile Glu Ala Pro Phe  
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Phe Lys Ser Tyr Leu Lys Asp Gly Lys Pro Ala Ala Thr Pro Glu Ala  
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Thr Ile Phe Glu Ser Gly Thr Asn Arg Trp Arg Ser Phe Glu Thr Trp  
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Pro Pro Lys Glu Ala Lys Glu Arg Thr Leu Tyr Phe Gln Ser Ala Gly  
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Lys Ile Gly Phe Glu Lys Pro Ala Ser Gly Leu Glu Tyr Asp Gln Phe  
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Leu Ser Asp Pro Ala His Pro Val Pro Phe Thr Glu Ala Thr Ala Thr  
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Gly Met Thr Arg Glu Tyr Met Thr Asp Asp Gln Arg Phe Ala Ser Arg  
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Arg Pro Asp Val Leu Thr Tyr Gln Thr Glu Ala Leu Thr Glu Asp Met  
485 490 495

Thr Leu Ala Gly Pro Ile Glu Ala Leu Leu Gln Val Ala Thr Thr Gly  
500 505 510

Thr Asp Ala Asp Trp Val Val Lys Ile Ile Asp Val Tyr Pro Asp Asp  
515 520 525

Thr Pro Asn Asn Pro Ser Thr Asn Pro Ala Val Lys Leu Gly Gly Tyr  
530 535 540

Gln Gln Met Val Arg Ser Glu Val Met Arg Gly Arg Phe Arg Asn Ser  
545 550 555 560

Phe Ser Lys Pro Glu Ala Phe Val Pro Glu Gln Val Thr Ala Val Pro  
565 570 575

Phe Thr Val Gln Asp Leu Cys His Thr Phe Arg Lys Gly His Arg Leu  
580 585 590

Met Val Gln Val Gln Ser Ser Trp Phe Pro Ile Val Asp Arg Asn Pro  
595 600 605

Gln Thr Phe Val Pro Asn Ile Phe Glu Ala Asp Glu Lys Asp Phe Gln  
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Val Phe Tyr Thr Leu Phe Leu Met Thr Thr Asn Trp Ala Leu Ser Gln	
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Ala Ile Asn Gly Tyr Asp Lys Ala Ala Tyr Asp Ile Pro Met Arg Asp	
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gga gtt cac ctt cac acc atc gtc tat agc ccc aaa gat tta tcg cag	196
Gly Val His Leu His Thr Ile Val Tyr Ser Pro Lys Asp Leu Ser Gln	
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ccc tat cct ata ttg atg caa agg aca cct tac agc gcc ggc cct tat	244
Pro Tyr Pro Ile Leu Met Gln Arg Thr Pro Tyr Ser Ala Gly Pro Tyr	
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ggt cct gga aat atg aaa aat aag ctt ggc cct tct cag ttt tta atg	292
Gly Pro Gly Asn Met Lys Asn Lys Leu Gly Pro Ser Gln Phe Leu Met	
75 80 85	
aac gat ggc tat ata ttt gtt tac cag gat gta aga ggg cgg tgg atg	340
Asn Asp Gly Tyr Ile Phe Val Tyr Gln Asp Val Arg Gly Arg Trp Met	
90 95 100	
tcg gaa gga tcc tat gac aac atg cgc cct acc cta tcc aaa tca gaa	388
Ser Glu Gly Ser Tyr Asp Asn Met Arg Pro Thr Leu Ser Lys Ser Glu	
105 110 115 120	
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Arg Asn Ser Asn Gln Ile Asp Glu Ser Thr Asp Thr Tyr Asp Thr Ile	
125 130 135	
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Glu Trp Leu Leu Ala Asn Ile Lys Asn His Asn Glu Lys Val Gly Leu	
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tgg gga atc agc tat ccc gga ttt tat agt gct gca gcc ctt cct ttt	532
Trp Gly Ile Ser Tyr Pro Gly Phe Tyr Ser Ala Ala Ala Leu Pro Phe	
155 160 165	
gcc cat cca aac ctg aaa gcc gtt tcc cct caa gca ccc ata ggg gat	580
Ala His Pro Asn Leu Lys Ala Val Ser Pro Gln Ala Pro Ile Gly Asp	
170 175 180	
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Phe 185	Tyr	Phe	Asp	Asp	Phe 190	His	His	Asn	Gly	Ala 195	Tyr	Leu	Leu	Ser	Tyr 200	
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Trp	Leu	Ala	Thr	Ser 205	Val	Phe	Gly	Tyr	Gln 210	Lys	Asp	Gly	Pro	Thr 215	Gln	
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Phe	Phe	Met 235	Asp	Met	Gly	Pro	Leu 240	Lys	Asn	Ala	Asp	Lys 245	Trp	Tyr	Gly	
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Glu	Asp 250	Asn	Phe	Phe	Trp	Gln 255	Gln	Leu	Lys	Asn	Asn 260	Pro	Asp	Tyr	Asn	
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Ala 265	Phe	Trp	Gln	Lys	Arg 270	Ser	Ile	Ile	Pro	His 275	Leu	Lys	Glu	Val	Lys 280	
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Tyr	Asn	Thr 315	Ile	Val	Met	Gly	Pro 320	Trp	Ser	His	Gly	Asp 325	Trp	Ser	Arg	
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ccc	tct	aat	cct	gtc	ccc	tat	agt	caa	gat	att	aaa	cta	aac	ttc	act	1348
Pro	Ser	Asn	Pro	Val	Pro	Tyr	Ser	Gln	Asp	Ile	Lys	Leu	Asn	Phe	Thr	
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Pro	Arg	Lys	Tyr	Met	Ala	Asp	Asp	Gln	Arg	Phe	Ala	Ala	Arg	Arg	Pro	
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Asp	Val	Leu	Thr	Phe	Thr	Ser	Glu	Val	Leu	Ser	Gln	Asp	Met	Thr	Leu	
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Ala	Asp	Trp	Val	Val	Lys	Ile	Ile	Asp	Ile	Phe	Pro	Gly	Asp	Gln	Pro	
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Asn	His	Ala	Tyr	Val	Leu	Asp	Gly	Val	Asp	Met	Gly	Asn	Tyr	His	Leu	
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Met	Val	Arg	Ser	Glu	Val	Ile	Arg	Gly	Arg	Tyr	Arg	Glu	Ser	Phe	Glu	
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Phe	Pro	Lys	Pro	Phe	Val	Pro	Asp	Gln	Ile	Thr	Ala	Val	Asp	Phe	Arg	
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Leu	Gln	Asp	Leu	Phe	His	Thr	Phe	Lys	Lys	Gly	His	Lys	Ile	Gln	Ile	
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Gln	Ile	Gln	Ser	Thr	Trp	Phe	Pro	Leu	Ile	Asp	Arg	Asn	Pro	Gln	Lys	
	570					575					580					
tat	gta	caa	aac	ata	ttt	gaa	gct	gag	gaa	gcc	gat	ttt	gtc	aaa	gcc	1828
Tyr	Val	Gln	Asn	Ile	Phe	Glu	Ala	Glu	Glu	Ala	Asp	Phe	Val	Lys	Ala	
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Ala Tyr Asp Ile Pro Met Arg Asp Gly Val His Leu His Thr Ile Val  
35 40 45

Tyr Ser Pro Lys Asp Leu Ser Gln Pro Tyr Pro Ile Leu Met Gln Arg  
50 55 60

Thr Pro Tyr Ser Ala Gly Pro Tyr Gly Pro Gly Asn Met Lys Asn Lys  
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Leu Gly Pro Ser Gln Phe Leu Met Asn Asp Gly Tyr Ile Phe Val Tyr  
85 90 95

Gln Asp Val Arg Gly Arg Trp Met Ser Glu Gly Ser Tyr Asp Asn Met  
100 105 110

Arg Pro Thr Leu Ser Lys Ser Glu Arg Asn Ser Asn Gln Ile Asp Glu  
115 120 125

Ser Thr Asp Thr Tyr Asp Thr Ile Glu Trp Leu Leu Ala Asn Ile Lys  
130 135 140

Asn His Asn Glu Lys Val Gly Leu Trp Gly Ile Ser Tyr Pro Gly Phe

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Tyr	Ser	Ala	Ala	Ala	Leu	Pro	Phe	Ala	His	Pro	Asn	Leu	Lys	Ala	Val
				165					170					175	
Ser	Pro	Gln	Ala	Pro	Ile	Gly	Asp	Phe	Tyr	Phe	Asp	Asp	Phe	His	His
			180					185					190		
Asn	Gly	Ala	Tyr	Leu	Leu	Ser	Tyr	Trp	Leu	Ala	Thr	Ser	Val	Phe	Gly
		195					200					205			
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	210					215					220				
Pro	Glu	Thr	Asn	Asp	Gly	Tyr	Gln	Phe	Phe	Met	Asp	Met	Gly	Pro	Leu
225					230					235					240
Lys	Asn	Ala	Asp	Lys	Trp	Tyr	Gly	Glu	Asp	Asn	Phe	Phe	Trp	Gln	Gln
				245					250					255	
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			260					265					270		
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		275					280					285			
Trp	Phe	Asp	Ala	Glu	Asp	Leu	Tyr	Gly	Pro	Leu	Thr	Ile	Tyr	Lys	Thr
	290					295					300				
Ile	Glu	Lys	Asn	Asn	Pro	Glu	Thr	Tyr	Asn	Thr	Ile	Val	Met	Gly	Pro
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Trp	Ser	His	Gly	Asp	Trp	Ser	Arg	Glu	Pro	Gly	Ser	Gln	Val	Ile	Ser
				325					330					335	
Asn	Ile	Tyr	Phe	Gly	Asp	Ser	Ile	Ser	Thr	Trp	Tyr	Gln	Lys	Asn	Ile
			340					345					350		
Glu	Arg	Val	Phe	Phe	Asn	His	Phe	Leu	Lys	Glu	Ser	Glu	Asn	Ser	Asn

355

360

365

Pro Ala Leu Pro Glu Ala Tyr Met Phe Asp Thr Gly Lys His Lys Trp  
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Glu Lys Phe Asp Asp Trp Pro Pro Lys Glu Ser Gln Trp Lys Ser Phe  
 385 390 395 400

Tyr Phe Gln Glu Lys Gly Glu Leu Thr Glu Val Thr Pro Glu Gly Asn  
 405 410 415

Arg Phe Thr Thr Tyr Val Ser Asp Pro Ser Asn Pro Val Pro Tyr Ser  
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Gln Asp Ile Lys Leu Asn Phe Thr Pro Arg Lys Tyr Met Ala Asp Asp  
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Gln Arg Phe Ala Ala Arg Arg Pro Asp Val Leu Thr Phe Thr Ser Glu  
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Val Leu Ser Gln Asp Met Thr Leu Ala Gly Glu Val Met Ala Asn Leu  
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Lys Val Ala Thr Ser Gln Thr Asp Ala Asp Trp Val Val Lys Ile Ile  
 485 490 495

Asp Ile Phe Pro Gly Asp Gln Pro Asn His Ala Tyr Val Leu Asp Gly  
 500 505 510

Val Asp Met Gly Asn Tyr His Leu Met Val Arg Ser Glu Val Ile Arg  
 515 520 525

Gly Arg Tyr Arg Glu Ser Phe Glu Phe Pro Lys Pro Phe Val Pro Asp  
 530 535 540

Gln Ile Thr Ala Val Asp Phe Arg Leu Gln Asp Leu Phe His Thr Phe  
 545 550 555 560

Lys Lys Gly His Lys Ile Gln Ile Gln Ile Gln Ser Thr Trp Phe Pro

565

570

575

Leu Ile Asp Arg Asn Pro Gln Lys Tyr Val Gln Asn Ile Phe Glu Ala  
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Ser Cys Asn Lys Ala Asn Lys Asp Ala Thr Glu Ile Val Lys Thr Glu  
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Arg Gly Arg Trp Met Ser Glu Gly Val Tyr Asp Asn Met Arg Ala Tyr	
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Ile Pro Asn Lys Thr Glu Asp Ser Gln Ile Asp Glu Ala Ser Asp Thr	
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Ser Thr Ile Asp Ala His Pro Ala Leu Lys Ala Ala Ser Pro Gln Ala	
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Cys Ile Gly Asp Phe Phe Phe Asp Asp Phe His His Asn Gly Ala Phe	
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Lys Pro Thr Asp Ser Ala Trp Tyr Lys Phe Pro Glu Met Lys Thr Gln	
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Asp Gln Tyr Gln Phe Phe Leu Asp Ala Gly Pro Leu Ser Asn Leu Asn	
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Lys Tyr Phe Gln Tyr Asp Thr Pro Asp Asp Thr Ser Val Ser Lys Ser	
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Asp Arg Ile Asp Asp Val Phe Trp Lys Glu Ile Val Glu His Pro Asn	
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Tyr Asp Thr Ile Trp Lys Ser Lys Gly Leu Ile Gln Asn Leu Lys Asp	
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Ile Lys Pro Ser Val Ala Thr Met Ile Val Gly Gly Leu Phe Asp Ala	
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Glu Asp Leu Tyr Gly Pro Phe Glu Thr Tyr Lys Thr Ile Glu Lys His	
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Val Ser Asp Leu Lys Arg Pro Val Pro Tyr Ser Glu Asp Ile Lys Thr	
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Arg Arg Pro Asp Val Leu Ile Phe Glu Thr Asp Ile Leu Glu Glu Asp	
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580 585 590	
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Lys Leu Gln Val Gln Val Gln Ser Thr Trp Phe Pro Leu Ile Asp Leu	
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Asn Pro Gln Thr Phe Val Pro Asn Ile Tyr Lys Ala Lys Glu Ser Asp	
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Phe Lys Thr Gln Thr His Ser Val Phe Asn Asp Ser Lys Ile Glu Phe	
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Lys	Asp	Glu	Ser	Gln	Thr	Tyr	Pro	Ile	Leu	Met	Met	Arg	Thr	Pro	Tyr	65	70	75	80
Ser	Ser	Gln	Pro	Tyr	Gly	Asp	Asn	Glu	Phe	Lys	Thr	Lys	Ile	Gly	Pro	85	90	95	
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Asn	Val	Gly	Thr	Trp	Gly	Ile	Ser	Tyr	Pro	Gly	Phe	Tyr	Ala	Thr	Tyr	165	170	175	
Ser	Thr	Ile	Asp	Ala	His	Pro	Ala	Leu	Lys	Ala	Ala	Ser	Pro	Gln	Ala	180	185	190	
Cys	Ile	Gly	Asp	Phe	Phe	Phe	Asp	Asp	Phe	His	His	Asn	Gly	Ala	Phe	195	200	205	
Leu	Leu	Ser	Tyr	Phe	Arg	Ala	Val	Ser	Leu	Phe	Gly	Thr	Thr	Lys	Asp	210	215	220	
Lys	Pro	Thr	Asp	Ser	Ala	Trp	Tyr	Lys	Phe	Pro	Glu	Met	Lys	Thr	Gln	225	230	235	240

Asp Gln Tyr Gln Phe Phe Leu Asp Ala Gly Pro Leu Ser Asn Leu Asn  
 245 250 255

Lys Tyr Phe Gln Tyr Asp Thr Pro Asp Asp Thr Ser Val Ser Lys Ser  
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Asp Arg Ile Asp Asp Val Phe Trp Lys Glu Ile Val Glu His Pro Asn  
 275 280 285

Tyr Asp Thr Ile Trp Lys Ser Lys Gly Leu Ile Gln Asn Leu Lys Asp  
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Ile Lys Pro Ser Val Ala Thr Met Ile Val Gly Gly Leu Phe Asp Ala  
 305 310 315 320

Glu Asp Leu Tyr Gly Pro Phe Glu Thr Tyr Lys Thr Ile Glu Lys His  
 325 330 335

Asn Pro Asp Asn Tyr Asn Ile Met Val Phe Gly Pro Trp Asp His Gly  
 340 345 350

Arg Trp Ala Arg Ser Asp Val Lys Asn Tyr Val Gly Asn Tyr Phe Phe  
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 370 375 380

Phe Asn His Phe Leu Lys Gly Lys Gly Asp Lys Asn Ser Gly Leu Pro  
 385 390 395 400

Glu Ala Tyr Val Phe Asp Ser Gly Lys Lys Glu Trp Ser Ser Phe Asp  
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Ser Trp Pro Pro Lys Gln Ala Glu Lys Gln Ala Met Tyr Leu Asn Ala  
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Val Ser Asp Leu Lys Arg Pro Val Pro Tyr Ser Glu Asp Ile Lys Thr  
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Ile Thr Leu Ala Gly Asp Ile Leu Ala Gln Leu Asn Val Ser Thr Thr  
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Asn Tyr His Leu Met Val Arg Ser Glu Val Met Arg Gly Arg Phe Arg  
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Asn Ser Phe Glu Asn Pro Glu Pro Phe Val Pro Asn Gln Pro Thr Asp  
565 570 575

Val Asn Ile Lys Leu Gln Asp Val His His Thr Phe Lys Lys Gly His  
580 585 590

Lys Leu Gln Val Gln Val Gln Ser Thr Trp Phe Pro Leu Ile Asp Leu  
595 600 605

Asn Pro Gln Thr Phe Val Pro Asn Ile Tyr Lys Ala Lys Glu Ser Asp  
610 615 620

Phe Lys Thr Gln Thr His Ser Val Phe Asn Asp Ser Lys Ile Glu Phe  
625 630 635 640

Thr Val Leu Lys